

Attorney Docket No.: 01CON334P
Application Serial No.: 09/782,791

REMARKS

This is in response to the *Non-Final* Office Action, dated July 13, 2005, where the Examiner has rejected claims 1-13, 15-47 and 49-70. Reconsideration and allowance of outstanding claims 1-13, 15-47 and 49-70 in view of the following remarks are requested.

A. Rejections of Claims 1-5, 12, 13, 15-20, 27-34, 42-47, 49, 54-58 and 63-66 under § 103(a)

The Examiner has rejected claims 1-5, 12, 13, 15-20, 27-34, 42-47, 49, 54-58 and 63-66 under 35 USC §103(a) as being unpatentable over U.S. Patent Number 6,453,289 to Ertem, et al. ("Ertem") in view of U.S. Patent Number 4,630,304 to Borth, et al. ("Borth"). For the reasons discussed below, applicant respectfully submits that the present invention, as defined by independent claims 1, 16, 30, 45, 55 and 63, is patentably distinguishable over Ertem in view of Borth.

First, applicant respectfully submits that the cited references fail to disclose, teach or suggest "wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation," as recited in claim 1. As acknowledged by the Examiner, Ertem does not disclose such element. (Office Action, Page 3, Line 3-4.) Further, Borth does not come close to disclosing such element. Applicant respectfully submits that, at best, Borth describes modifying spectral magnitudes of the digitized signal in frequency-domain to generate a noise-reduced digitized signal, as recited in claim 1. However, Borth falls short of describing elements of the second stage of noise reduction process of claim 1, which begins after transforming the noise-reduced digitized signal back to time-domain. Therefore,

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Borth also fails to disclose “wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation,” as recited in claim 1.

Applicant respectfully submits that in the second stage of the noise reduction process of claim 1, the encoder receives the noise-reduced digitized signal in time-domain, and provides a bitstream based upon a speech coding of the noise-reduced digitized signal; “where the speech coding determines at least one gain scaling a portion of the noise-reduced digitized signal; and where the encoder adjusts the at least one gain as a function of noise characteristic for attenuating background noise in at least one frame, wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation.”

Embodiments according to the present invention relate to digital speech coding systems having noise suppression capabilities. Conventional frequency-domain noise suppression techniques reduce some background noise in speech frames. However, the conventional frequency-domain techniques introduce significant speech distortion if the background noise is excessively suppressed. The frequency-domain noise suppression techniques may produce a relatively unnatural sound overall, especially when the background noise is excessively suppressed.

Embodiments according to the present invention relate to a noise suppression system and method that accurately reduces the background noise in a speech coding system. Advantageously, the present system utilizes a gain factor G_f to suppress the background noise in the time domain while maintaining the speech signal. For example, independent claim 1 recites “adjusting at least one gain as a function of noise characteristic for attenuating background noise

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in at least one frame, wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation”.

In contrast, Ertem utilizes a voice activity detector (VAD) that employs line spectral frequencies and enhanced input speech which has undergone noise reduction to generate a voice activity flag. A gain function is smoothed both across frequency and time in an adaptive manner based on an estimate of the signal-to-noise (SNR) ratio. As stated in Ertem and shown in FIG. 7 of Ertem, the input speech signals goes through the FFT process (see block 90), and then in block 98 and in the frequency domain, “gain functions are computed ... using the smoothed noise spectral estimate and the input signal spectrum” (Col. 11, lines 58-61.) Thereafter, in block 104, an inverse FFT is applied to the frequency domain sequence to obtain the time domain signal. (Col. 12, lines 9-13.)

Therefore, Ertem does not disclose, teach, or even suggest that the gain factor is adjusted in the time domain; rather, Ertem discloses that gain functions are computed using the smoothed noise spectral estimate and the input signal spectrum in the frequency domain. In contrast, claim 1 recites “wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation.”

Furthermore, Borth, at best, discusses the first stage of noise reduction according to claim 1, and fails to disclose, teach or suggest the second stage of noise reduction according to claim 1, let alone suggesting that “the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation.”

For the foregoing reasons, applicant respectfully submits that the present invention as defined by independent claims 1, 16, 30, 45, 55 and 63 is not taught, disclosed, or suggested by

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Ertem and Borth. Thus, independent claims 1, 16, 30, 45, 55 and 63 are patentably distinguishable over Ertem and Borth. As such, the claims depending from independent claims 1, 16, 30, 45, 55 and 63 are, *a fortiori*, also patentably distinguishable over Ertem in view of Borth for at least the reasons presented above and also for additional limitations contained in each dependent claim.

B. Rejections of Claims 6-11, 21-26, 35-41, 50-53, 59-62, and 67-70 under 35 USC §103(a)

The Examiner has rejected claims 6-11, 21-26, 35-41, 50-53, 59-62, and 67-70 under 35 USC §103(a) as being unpatentable over the combination of Ertem in view of Borth in further view of U.S. Patent Number 6,161,090 to Chandran, et al. ("Chandran"). Applicant respectfully submits that claims 6-11, 21-26, 35-41, 50-53, 59-62, and 67-70 depend from independent claims 1, 16, 30, 45, 55, and 63, respectively, and thus, claims 6-11, 21-26, 35-41, 50-53, 59-62, and 67-70 should be allowed at least for the same reasons discussed above in conjunction with patentability of independent claims 1, 16, 30, 45, 55, and 63.

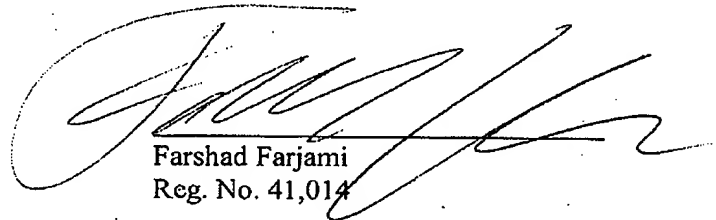
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C. Conclusion

For all the foregoing reasons, an early Notice of Allowance directed to all claims 1-13, 15-47 and 49-70 pending in the present application is respectfully requested.

Respectfully Submitted,
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